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CORRELATION OF THE DEVONIAN FAUNAS IN SOUTHERN ILLINOIS.

INTRODUCTION.

THE Devonian faunas of the interior of America are of two distinct types, and occur in two more or less distinct geological provinces. The eastern interior province is typically represented in New York; it extends westward into Canada and southwestward into the Ohio valley. The western interior province is typically represented in Iowa; it extends to the northwest into British America and is connected with the European region. The southern Illinois Devonian is of much interest because of its geographic position between the New York and the Iowan areas, but in all the study which has hitherto been devoted to the region, it has never been definitely shown with which one of these provinces it is connected. Recent investigation shows the Devonian faunas in southern Illinois to be intimately related to the New York faunas, and that the strata containing them are but a western extension of the formations of the eastern province.

The "Devil's Back Bone" and the "Devil's Bake Oven," near Grand Tower, in Jackson county, Illinois, have long been recognized as localities rich in Devonian fossils. In 1855 Norwood and Pratten[1] described as new several species of *Chonetes* from this locality. In 1867 Hall made frequent mention, in Vol. IV of the Palæontology of New York, of the occurrence of species of brachiopods at the "Bake Oven," Jackson county, Illinois, and a few were described from this locality exclusively. In 1868 the geology of Jackson county was published in Vol. III of the Geological Survey of Illinois, several sketches of the "Bake Oven" and the "Back Bone" being reproduced and mention being made of the fossils collected. In the same volume are descriptions and illustrations of several species of fossils from the locality.

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[1] Jour. Acad. Nat. Sci., Phil., ser. 2, Vol. III, pp. 23–32.

The "Back Bone" is a narrow, rocky ridge, rising about one hundred feet above river level and extending northward from the town of Grand Tower along the east bank of the Mississippi River for a distance of about one-half mile. It consists of strata of Devonian limestone, with beds which are probably of Lower Helderberg age below, dipping to the northeast at an angle of about 25°. The "Bake Oven" is really the northern end of this ridge, but is isolated from the main "Back Bone" by an interval of several hundred feet.

The field work upon which the present paper is based was done in August 1896. As the time which could be devoted to the work was limited, it was concentrated upon the north face of the "Bake Oven." The section here studied is about 167 feet in thickness. An attempt was made to select the fossil-bearing zones in the section, and to make as complete collections from them as the time would allow. Twenty-six zones were recognized, eighteen of them being fossil-bearing to a greater or less extent. Additional time in the field would doubtless materially increase the number of species, and perhaps the number of zones, and a careful examination of the entire "Back Bone" would be exceedingly valuable.

DESCRIPTION OF THE SECTION, WITH LISTS OF FOSSILS.

The field number given to the section was *5A*. The beds, with their fossil contents, will be described, beginning with the lowest, $5A^1$ and passing upward through the successive zones to $5A^{26}$, which is the highest. The relative abundance of the species is designated as follows: (a) abundant, (c) common, (r) rare.

$5A^1$ About fifteen feet of coarsely crystalline, gray limestone exposed, variable in texture, and often more or less arenaceous, especially near the top. Fossils numerous but not well preserved.

1. *Leptæna rhomboidalis* Wilck. (c).
2. *Chonetes laticosta* Hall ? (r).

3. *Orthis* (*Rhipidomella*) *semele* Hall ? (a).
4. *Rhynchonella sp.* (r).
5. *Eatonia sp.* (r).
6. *Cyrtina hamiltonensis* Hall (r).
7. *Spirifer macrothyris* Hall (c).
8. *Spirifer raricostus* Conrad (c).
9. *Nucleospira elegans* Hall ? (r).
10. *Nucleospira ventricosa* Hall (r).
11. *Meristella sp.* (c).
12. *Platyceras sp.* (a).
13. *Orthoceras sp.* (r).
14. *Phacops cristata* Hall ? (r).
15. *Coral*, fragments (r).
16. *Bryozoa*, fragments (c).
17. *Fish teeth*, fragments (r).

*5A*² Two and one-half feet of rather coarse, light-colored sandstone. Fossils similar to those in the bed below, but poorly preserved.

1. *Leptæna rhomboidalis* Wilck. (c).
2. *Chonetes laticosta* Hall (r).
3. *Orthis* (*Rhipidomella*) *semele* Hall ? (c).
4. *Eatonia sp.* (r).
5. *Spirifer macrothyris* Hall ? (r).
6. *Spirifer sp.* (r).
7. *Nucleospira elegans* Hall ? ? (r).
8. *Platyceras sp.* (a).
9. *Dalmanites sp.* (r).

*5A*³ Forty-five feet of impure, thin, irregularly bedded, dark limestone, variable in texture, and affording no fossils. Doubtless a more thorough examination of these beds would disclose a more or less abundant fauna.

*5A*⁴ Six inches of impure, shaly limestone, lighter colored than that below and much decomposed upon the surface. Fossils poorly preserved.

1. *Pholidostrophia nacrea* Hall (r).
2. *Chonetes laticosta* Hall (r).
3. *Orthis* (*Rhipidomella*) *sp.* (c).
4. *Rhynchonella sp.* (r).
5. *Centronella glans-fagea* Hall (r).
6. *Spirifer duodenaria* Hall (c).
7. *Spirifer sp.* (r).
8. *Platyceras sp.* (r).
9. *Pleurotomaria* ? *sp.* (r).
10. *Phacops cristata* Hall ? (r).
11. *Bryozoa*, fragments (a).

$5A^{5}$. Ten inches of dark brown, impure, limestone, with chert nodules.

1. *Productella spinulicosta* Hall (r).
2. *Dielasma ? sp.* (r).
3. *Spirifer grieri* Hall (r).
4. *Platyceras*, cf. young of *P. bucculentum* Hall (r).
5. *Phacops cristata* Hall *?* (r).
6. *Bryozoa*, fragments (a).

$5A^{6}$. Four and one-half feet of unevenly bedded, partially crystalline, impure brown limestone.

1. *Strophodonta patersoni* Hall (c).
2. *Strophonella ampla* Hall (r).
3. *Chonetes mucronata* Hall (a).
4. *Orthis* (*Rhipidomella*) *vanuxemi* Hall *var?* (r).
5. *Orthis* (*Schizophoria*) *propinqua* Hall (a).
6. *Atrypa reticularis* Linn. (c).
7. *Cyrtina hamiltonensis* Hall (r).
8. *Spirifer grieri* Hall (r).
9. *Paracyclas elliptica* Hall (r).
10. *Platyceras sp.* (c).
11. *Lichas* (*chonolichas*) *eriopsis* Hall ? (r).
12. *Phacops cristata* Hall ? (r).
13. *Cystodictya sp.* (a).

$5A^{7}$. Six feet four inches of thin, unevenly bedded gray-brown limestone nearly identical in lithological characters with the last.

1. *Strophodonta patersoni* Hall (c).
2. *Chonetes mucronata* Hall (a).
3. *Orthis* (*Rhipidomella*) *vanuxemi* Hall *var?* (c).
4. *Atrypa reticularis* Linn. (c).
5. *Spirifer varicosus* Hall (r).
6. *Nucleospira concinna* Hall ? (r).

$5A^{8}$. One foot four inches of impure, semicrystalline, brown limestone with numerous fragments of corals too imperfectly preserved for identification.

$5A^{9}$. Three feet of limestone similar to the last but without fossils.

$5A^{10}$. One foot of limestone similar to the last.

1. *Strophodonta concava* Hall (r).
2. *Corals*, imperfect fragments (a).

$5A^{11}$. Three feet ten inches of hard, brittle, semicrystalline, much fractured limestone, with an abundant fauna.

1. *Strophodonta patersoni* Hall (a).
2. *Strophodonta concava* Hall (a).
3. *Strophodonta perplana* Conrad (c).
4. *Strophodonta inequistriata* Conrad (c).

5. *Strophodonta demissa* Conrad (r).
6. *Pholidostrophia nacrea* Hall (r).
7. *Leptæna rhomboidalis* Wilck. (r).
8. *Orthothetes chemungensis* Conrad var. *arctostriata* Hall (r).
9. *Orthothetes chemungensis* Conrad var. *pandora* Billings (c).
10. *Chonetes mucronata* Hall (a).
11. *Productella spinulicosta* Hall (r).
12. *Orthis* (*Rhipidomella*) *vanuxemi* Hall *var.?* (a).
13. *Orthis* (*Schizophoria*) *propinqua* Hall (r).
14. *Rhynchonella louisvillensis* Nettelroth ? (r).
15. *Rhynchonella cf. horsfordi* Hall (r).
16. *Rhynchonella* (*Pugnax*) *sp.* (r).
17. *Atrypa reticularis* Linn. (a).
18. *Cyrtina hamiltonensis* Hall (a).
19. *Spirifer varicosus* Hall (a).
20. *Spirifer duodenaria* Hall (c).
21. *Nucleospira concinna* Hall (r).
22 *Paracyclas elliptica* Hall (r).
23. *Modiomorpha ? cf. M. recta* Hall (r).
24. *Grammysia cf. rhomboidalis* M. & W. (r).
25. *Conocardium cuneus* Conrad (c).
26. *Aviculopecten sp.* (a).
27. *Pterinea sp.* (r).
28. *Pterinea flabellum* Conrad ? (r).
29. *Platyceras bucculentum* Hall ? (c).
30. *Callonema lichas* Hall ? (c).
31. *Loxonema ? cf. L. pexatum* Hall ? (c).
32. *Bellerophon 2 sp.* (r).
33. *Lichas* (*Ceratolichas*) *cf. grypes* Hall (r).
34. *Dalmanites cf. calypso* Hall *cf. erina* Hall (c).
35. *Phacops cristata* Hall ? var. (r).
36. *Zaphrentis ?* imperfect fragments (c).
37. *Bryozoa* fragments (c).
38. *Fish Teeth* fragments (r).

5A^{12}. Nine feet of impure, brown limestone with thin bands of chert. No fossils collected.

5A^{13}. Five feet of limestone similar to the last.

1. *Strophodonta perplana* Conrad (c).
2. *Strophodonta demissa* Conrad (r).
3. *Strophodonta inequiradiata* Hall (c).
4. *Orthothetes chemungensis* Conrad *var. pandora* Billings (c).
5. *Chonetes mucronata* Hall (a).

6. *Productella Spinulicosta* Hall (r).
7. *Pentamerella cf. arata* Conrad (r).
8. *Rhynchonella sappho* Hall (r).
9. *Rhynchonella cf. horsfordi* Hall (r).
10. *Dielasma ? sp.* (r).
11. *Atrypa reticularis* Linn. (a).
12. *Spirifer sp.* (r).
13. *Paracyclas elliptica* Hall (r).
14. *Phacops cristata* Hall ? *var.* (r).
15. *Bryozoa*, fragments (a).

5A[14]. Twenty feet of impure brown limestone, variable in character and texture, thin bedded and shaly in part.

5A[15]. Five feet of impure reddish brown limestone.

1. *Strophodonta concava* Hall (a).
2. *Strophodonta demissa* Conrad (c).
3. *Leptæna rhomboidalis* Wilck. (a).
4. *Chonetes cf. deflecta* Hall (a).
5. *Orthis (Rhipidomella) vanuxemi* Hall (c).
6. *Paracyclas elliptica* Hall (r).
7. *Bellerophon sp.* (r).
8. *Gomphoceras lunatum* Hall ? (c).
9. *Gomphoceras impar* Hall ? (c).

5A[16]. Three feet ten inches of brown limestone.

1. *Strophodonta inequiradiata* Hall (r).
2. *Chonetes cf. deflecta* Hall (r).
3. *Orthis (Rhipidomella) vanuxemi* Hall ? var. (a).
4. *Orthis (Schizophoria) ? sp.* (a).
5. *Spirifer sp.* (r).
6. *Paracyclas elliptica* Hall (r).

5A[17]. Five feet five inches of impure brown limestone. No fossils collected.

5A[18]. Three feet six inches of impure, reddish-brown limestone, composed almost wholly of a single species of *Chonetes.*

1. *Chonetes yandellana* Hall (a).
2. *Productella spinulicosta* Hall ? (r).
3. *Productella sp.* (r).
4. *Camarophoria sp.* (r).
5. *Dielasma cf. D ? navicella* Hall (r).
6. *Paracyclas elliptica* Hall (r).
7. *Platyceras sp.* (r).

5A[19]. Nine feet of impure brown limestone with few fossils.

$5A^{20}$. Two feet impure shaly brown limestone with multitudes of a single species of *Chonetes.*

1. *Chonetes littoni* N. & P.? (a).
2. *Spirifer fornaculus* M. & W. (r).

$5A^{21}$. Six feet of impure, thin bedded, brown limestone with few fossils.

$5A^{22}$. Six inches impure brown limestone.

1. *Pholidostrophia nacrea* Hall (a).
2. *Productella spinulicosta* Hall (r).
3. *Dielasma sp.* (r).
4. *Atrypa reticularis* Linn. (r).
5. *Spirifer ziczac* Hall ? (a).
6. *Spirifer fornaculus* M. & W. (r).
7. *Favosites ? sp.* (r).

$5A^{23}$. Three feet of dark, often nearly black, somewhat siliceous limestone with many fossils.

1. *Strophodonta inequiradiata* Hall (a).
2. *Strophodonta demissa* Conrad (c).
3. *Pholidostrophia nacrea* Hall (a).
4. *Leptæna rhomboidalis* Wilck. (a).
5. *Chonetes deflecta* Hall (a).
6. *Chonetes pusilla* Hall (a).
7. *Orthis (Schizophoria) iowensis* Hall (c).
8. *Spirifer fornaculus* M. & W. (c).
9. *Athyris vittata* Hall (c).
10. *Paracyclas elliptica* Hall (c).
11. *Paracyclas lirata* Conrad (r).
12. *Pleurotomaria sp.* (c).
13. *Bellerophon sp.* (r).
14. *Orthoceras sp.* (r).
15. *Phacops rana* Green (a).
16. *Proetus rowii* Green (r).
17. *Zaphrentis? sp.* (r).
18. *Cystodictya sp.* (a).

$5A^{24}$. Nine feet of unexposed, covered at the time of examination with mud and water.

$5A^{25}$. Three feet of dark brown impure limestone made up almost exclusively of specimens of *Chonetes coronata.*

1. *Chonetes coronata* Hall (a).
2. *Tropidoleptus carinatus* Conrad (a).
3. *Spirifer fornaculus* M. & W. (a).

4. *Bellerophon sp.* (r).
5. *Gyroceras cf. trivolve* Conrad (r).
6. *Tentaculites bellulus* Hall ? (c).
7. *Phacops rana* Green (c).
8. *Proetus canaliculatus* Hall (r).
9. *Zaphrentis sp.* (r).
10. *Cystodictya sp.* (c).

5A^{26}. Four inches of impure brown limestone like the last, but with few specimens of *Chonetes coronata.*

1. *Orthothetes chemungensis* Conrad *var pandora* Billings (r) .
2. *Chonetes coronata* Hall (c).
3. *Spirifer fornaculus* M. & W. (a).
4. *Gomphoceras sp.* (r).

DISCUSSION OF THE FAUNAS.

From a general survey of the entire fauna of the section, seven conspicuous divisions may be recognized. The first of these include zones *5A*^{1} and *5A*^{2}. The conspicuous species are *Orthis* (*Rhiphidomella*) *semele ?* and *Platyceras sp. Orthis* (*Rhipid.*) *semele* was originally described by Hall from very imperfect material found in the Onondaga limestone in Erie county, N. Y. The Illinois specimens are not perfectly preserved, but seem to agree more nearly with this species than with any other. The *Platyceras* is of a type which might be present in any fauna from the Lower Helderberg to the Hamilton inclusive. Well preserved specimens of *spirifer macrothyris* and *spirifer raricostus* are present, which are good Upper Helderberg species. Associated with these are *Nucleospira ventricosa* and *Nucleospira elegans ?* which were described from the Lower Helderberg, and an undescribed species of *Eatonia*, which genus has not hitherto been recognized above the Oriskany. There is no fauna comparable to this one in the western interior Devonian province, but in the eastern province this association of species is about equivalent to the lower half of the Upper Helderberg group in the New York series.

The second division of the general fauna includes zones *5A*^{4} to *5A*^{13}. The association of species in these zones is a typical

Corniferous limestone fauna, as seen in Indiana, Ohio, and New York. The conspicuous species in the fauna are the large and robust *Strophodontas*, the *Atrypa reticularis* of the large, robust form so common at the falls of the Ohio, *Spirifer varicosus*, *Spirifer duodenaria*, *Orthis* (*Schizophoria*) *propinqua*, *Paracyĉlas elliptica*, *Conocardium cuneus*, *Lichas* (*Ceratolichas*) *cf. grypes*, *Dalmanites cf. calypso cf. erina*, etc. Nowhere in the western interior province does a fauna at all allied to this one occur, but it is identical with the Corniferous fauna of the eastern province.

The third division may be called the *Gomphoceras* zone, and includes only the bed numbered $5A^{15}$. It is characterized by numerous specimens of several large, robust species of *Gomphoceras*. The specimens as they occur on the surface of the outcrop are generally too imperfect for certain identification, but are of a general type of the genus which is common in both the Corniferous and the Hamilton faunas. The associated species are nearly all identical with those in the Corniferous fauna below.

The fourth division is the *Chonetes yandellana* zone, $5A^{18}$. The bed is made up almost exclusively of multitudes of specimens of this one species, all the others recorded being rare or uncommon.

The fifth division is the *Chonetes littoni?* zone, $5A^{20}$. It is similar to the *Chonetes yandellana* zone in being made up almost entirely of great numbers of individuals of a single species of *Chonetes*. *C. littoni*, with three other species of the same genus, was originally described from this locality by Norwood and Pratten, but their descriptions and figures are so imperfect that it is difficult to recognize their species. In the faunas of the section there are three conspicuous *Chonetes* zones, each containing exclusively a single species of the genus. Three of Norwood and Pratten's species, *C. maclurei*, *C. martini*, and *C. tuomyi*, may be certainly identified as different stages of a single species, *C. coronatus*, which characterizes the uppermost *Chonetes* zone. The chances are, therefore, that their fourth species, *C. littoni*, is either one or the other of the two additional conspicuous species at the locality, and from careful examination and comparison of the specimens, descriptions and figures, it seems most probable that the species occurring in such numbers in zone *5A* [19] is the *C. littoni* of these authors.

The sixth division is zone *5A* [23], and has a fauna quite different from any of those below. *Leptæna rhomboidalis* is the most abundant species. Some of the additional conspicuous species are *Chonetes deflecta* and *Chonetes pusilla*, which are apparently variations of a single species, *Pholidastrophia nacrea*, *Athyris vittata* of the type common at the falls of the Ohio, *Phacops rana*, *Paracyclas elliptica* and *Paracyclas lirata*. As a whole the fauna is of a Hamilton facies, but is more like the Hamilton fauna at the falls of the Ohio than the typical New York fauna. *Orthis* (*Schizophoria*) *iowensis* is an uncommon species which is conspicuous in the Devonian faunas of Iowa, but is absent from the New York faunas until after the incursion of the Chemung faunas from the west.

The seventh and last division is zone *5A* [25], and may be termed the *Chonetes coronata* zone. The bed is made up of multitudes of individuals of *Chonetes coronata*, with perhaps one-tenth as many individuals of *Tropidoleptus carinatus*. Both of these species are peculiar forms and are characteristic of the New York Hamilton. They appear suddenly both in the New York and the Illinois localities without any known forerunners. *Tropidoleptus carinatus* is an abundant species in the South American Devonian faunas, and *Chonetes coronata* is of a type otherwise unknown in North America, but common in South America, where it is represented by *C. arcei Ulr.*, *C. rücki Ulr.*, and other species. There is evidence in the Hamilton fauna of the east-American province of an immigration from the southern hemisphere which did not affect the western Devonian faunas. The details of this epoch in Devonian history are not yet fully understood, but the presence of this *Chonetes coronata* and *Tropidoleptus* fauna marks the point where this immigration first made itself felt in the southern Illinois region.

CONCLUSION.

It is believed that the facts here set forth satisfactorily demonstrate that the Devonian faunas in southern Illinois are not related to the Iowan Devonian faunas as has sometimes been suggested, but are a western extension of the faunas of the New York province. At the " Bake Oven " section the fauna of the lowest beds is of an age corresponding to the lower portion of the Upper Helderberg period, while the uppermost faunas are of Hamilton age. The line of demarkation between the Upper Helderberg and Hamilton faunas cannot be exactly drawn, but it comes somewhere between zones $5A^{15}$ and $5A^{23}$.

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